Bunker Hill Mine Water Presumptive Remedy Workshop #2

March 3, 1999

Project Drivers

- Acid/Metal Laden Acid Mine Drainage
- Aquatic Toxicity if not Treated
- Existing Treatment Plant is 25 Years Old
- South Fork CDA River TMDLs
- Limited Remaining Sludge Disposal Volume
- Long-Term Significant Costs

Presumptive Remedy Process Objectives

- Develop the Most Cost-Effective Long-Term Remedy
- Use Existing Info. As Much as Possible
- Focus New Information Needs on the Remedy
- Focus ALL Efforts on the Remedy
- Use Cost/Benefit Analysis to Evaluate AMD Generation Mitigations

The Presumptive Remedy Process

1. Use Considerable Existing Information
2. Brainstorm "Presumptive Remedy" (Workshop #1)
3. ID Unknowns/Information Needs (Workshop #1)
4. Collect and Evaluate Information
5. Refine Presumptive Remedy (Workshop #2)
6. ID Unknowns/Information Needs (Workshop #2)
7. Collect and Evaluate Information
7. Refine Presumptive Remedy (Workshop #3)
8. ID Unknowns/Information Needs (Workshop #3)
9. Etc.

TABLE 2
Refined Presumptive Remedy Draft Pending Review by the EPA and IDEQ
Changes with Respect to the Initial Presumptive Remedy are Highlighted

Presumptive Remedy Element	Refined Description	Findings Which Affect the Initial Presumptive Remedy	New Information Needs and Next Steps for Remedy Development
AMD Generation Mitigations	Reduce surface water infiltration into the mine with emphasis on the AMD producing Flood-Stanly ore body by: Divert the West Fork of Milo Creek around the Guy Caving area Divert the South Fork of Milo Creek away from the losing streambed above the confluence with the Main Stem of Milo Creek Also: Divert Deadwood Creek around the Inez Shaft area on the mine's west side	Preliminary results from the cost benefit analysis show the two Milo Creek diversions to be cost effective based on reductions in AMD hydraulic load alone. The Deadwood Creek diversion around the Inez Shaft area was identified as promising to further reduce AMD hydraulic load.	Develop construction designs and refined cost estimate for the two Milo Creek diversions Preliminary design, cost estimate, and effectiveness estimation for the Deadwood Creek Diversion Cost/benefit analysis for the Deadwood Creek diversion Evaluate if the Flood-Stanly ore body can be further hydraulically isolated to reduce AMD contaminant load
AMD Collection	No change from initial presumptive remedy: Use the existing in-mine system of gravity flow ditches and pump system to collect the AMD for conveyance out the Kellogg Tunnel to treatment.	No Significant Findings Which Affect the Initial Presumptive Remedy	Develop an AMD collection system operations and maintenance (O&M) plan which describes the specific O&M procedures required for long-term AMD collection Update the collection cost estimates based on the O&M plan
AMD Conveyance	Use the existing pipeline from the Kellogg Tunnel Portal to convey the AMD into the treatment plant and to bypass the AMD into the lined pond during treatment plant shutdowns.	No significant findings which affect the initial presumptive remedy A 1,300-foot section of the 24-inch concrete pipe from the Kellogg Tunnel Portal should be lined with a 20-inch HDPE pipeline The 12-inch pipeline from the tee to the treatment plant should be replaced with a 16-inch pipeline when the treatment plant is upgraded	Develop a construction design and refined cost estimate for lining of the concrete pipeline

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Presumptive Remedy Element	Refined Description	Findings Which Affect the Initial Presumptive Remedy	New Information Needs and Next Steps for Remedy Development
AMD Storage	Use the existing lined pond (existing surface impoundment) And Use in-mine storage from bottom of 12 Level to bottom of 11 Level to temporarily store the AMD when either the conveyance or treatment systems are not operating.	Approximately 80 million gallons of in-mine storage can be obtained by storing from the bottom of 12 Level to the bottom of 11 Level. The additional storage provided by 13 Level (estimated at 190 million gallons) is not needed.	Develop an in-mine AMD storage operations and maintenance (O&M) plan which describes the specific O&M procedures required to use 12 Level for storage, and how the lined pond will be used in conjunction with in-mine storage Update the storage cost estimates based on the O&M plan
AMD Treatment	Upgrade and modernize the existing lime neutralization high density (HDS) sludge treatment plant, Add one of the following to remove additional metal: Add filters and sulfide precipitation Add filters and iron co-precipitation Add filters and sulfide functional Ion exchange Add evaporation and crystallization The object is to meet the draft TMDL-based treatment standards.	Polishing the effluent from the upgraded existing treatment plant by evaporation and crystallization of the evaporator salt is the only treatment process likely assured of meeting the draft TMDL based treatment standards for the 7Q10 river flow conditions. This would be an extremely expensive treatment system (30-year net present value of $190 million). The other treatment schemes require treatability testing and process development to meet the treatment requirements	Conduct a treatability study program to determine capabilities of other treatment schemes Conduct an evaluation of the required maximum design capacity of the treatment plant. The cost/benefit analysis shows the treatment costs to be very sensitive to maximum design capacity (currently 5,000 gpm) Refine the treatment schemes and cost estimates based on the results of the treatability study program and maximum design flow analysis

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Refined Presumptive Remedy Draft Pending Review by the EPA and IDEQ
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Presumptive Remedy Element	Refined Description	Findings Which Affect the Initial Presumptive Remedy	New Information Needs and Next Steps for Remedy Development
Treatment Sludge Management	Pump sludge from the treatment plant into sludge disposal beds constructed on the CIA. These beds both dewater and permanently contain the sludge.	Disposal of dewatered sludge in the Hanna stope was found to be very complex and full of uncertainties pertaining to how the stope could be modified to contain the sludge. Considerable additional information is needed to further develop this as a sludge disposal option. Recovery of zinc and manganese from the lime high density sludge was found to have a slightly lower 30-year NPV compared to sludge disposal beds. However, there is much more uncertainty in these costs because the metal recovery process has not been demonstrated at full-scale.	Develop a construction design and refined cost estimate for sludge disposal beds on the CIA. If possible merge construction with CIA closure to reduce costs. Continue to encourage private-sector development of sludge metal recovery with the goal of offsetting long-term disposal costs

TABLE 3
Cost Estimate Summary of the Refined Presumptive Remedy
Costs are Order-of-Magnitude

Presumptive Remedy Element	Description	Capital Cost ($)	Annual O&M ($/Year)	30-Year Net present Value (5% Interest) ($)
AMD Generation Mitigations	Divert the West and South Forks of Milo Creek to reduce infiltration to the mine	$1,780,000	**$21,000**	$2,100,000 (costs for a Deadwood Creek diversion are not included)
AMD Collection	Use existing in-mine collection system of drifts, ditches, and pump column.	Not Applicable	**$800,000**	$12,300,000
AMD Conveyance	Slip a 20-inch pipe into existing 24-inch concrete pipe from the portal, use other existing piping, upgrade 12-inch pipe to treatment plant. Typically operate by direct feed to CTP rather than into lined pond.	$380,000	**$1,000**	$410,000 (Includes $30,000 at year 15 for pipeline video inspection and valve replacement)
AMD Storage	Use existing lined pond and in-mine storage between bottom of 12 Level and bottom of 11 Level.	$150,000	**$127,000**	$2,090,000
AMD Treatment	Upgrade and modernize the existing lime neutralization high density sludge treatment plant. Add one of the following to remove additional metal: • Filters and sulfide precipitation • Filters and iron co-precipitation • Filters and sulfide functional ion exchange • Evaporation and crystallization	$8,310,000 (upgraded HDS + filters + sulfide precipitation) to $72,860,000 (upgraded HDS + evaporation and crystallization)	**$980,000** to **$7, 760,000**	$23,440,000 to $191,930,000 (costs to not include savings from water diversions, which vary by treatment scheme)
Treatment Sludge Management	Pump sludge from the treatment plant into sludge disposal beds constructed on the CIA. These beds both dewater and permanently contain the sludge.	$2,200,000	**$82,000**	$6,280,000 (includes costs for new beds in years 10 and 20.
Totals		**$12,820,000** to **$77,370,000**	**$2,011,000** to **$8,791,000**	**$46,620,000** to **$215,110,000**

Workshop Objectives

1. Discuss Draft Documents
2. Solicit Feedback and Comments
3. Discuss Refined Presumptive Remedy
4. Identify Changes/Modifications
5. Identify New Information Needs/Next Steps